THE TECHNOLOGY OF THE BUGATTI CHIRON PUR SPORT IN DETAIL



The Pur Sport is the most extreme hyper sports car created by Bugatti so far.

Extremely sporty and extraordinarily fast in corners. Consistently calibrated for agility, handling and driving performance. The new Bugatti Chiron Pur Sport[1] pushes the limits of what is technically feasible in the area of lateral dynamics. Bugatti engineers spent a year and half developing the new hyper sports car. Fine-tuning is now in the final stages, with test runs being carried out on race circuits, country roads and motorways, as well as test tracks such as Bilster Berg. In the second half of 2020, Bugatti will then build the series-production version of the Chiron Pur Sport, which will start at a net base price of three million euros (North America: base MSRP of $3,599,000).

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The engineers have succeeded in translating their vision of an even more handling-focused Chiron into an entirely new and higher performance vehicle concept as part of the Chiron^2 family. The Chiron Pur Sport is the ideal car for drivers who like to take corners at the lateral dynamics limits. ''This required fundamental and complex technical modifications, but you can feel the result directly,'' says Stefan Ellrott, Head of Development at Bugatti. ''The Chiron Pur Sport is much more agile, firm and precise. It's more hungry for corners, accelerates faster thanks to a shorter gear ratio and offers increased downforce thanks to new aerodynamics.''

SOPHISTICATED CHASSIS

One of the biggest changes the Chiron Pur Sport has undergone is in its chassis. On both axles, the engineers changed the camber to minus 2.5 degrees for a significant increase in performance. In order to integrate the negative camber settings, the engineers had to develop new suspension joints. From the wide-ranging possibilities available in terms of axle geometry, they used an elaborate process to calculate and simulate 17 different variants, ultimately opting for the one that harmonizes perfectly with the body, springs and tyres. New springs with a spring rate of 166 N/mm at the front and 200 N/mm at the rear instead of 100 N/mm at the front and 150 N/mm at the rear also ensure a very firm set-up without sacrificing ride comfort. ''The significantly harder springs offer the best compromise between sporty handling, traction and ride comfort for the Chiron Pur Sport. It took us many, many test kilometres to arrive at this conclusion,'' says Jachin Schwalbe, Head of Chassis Development at Bugatti. In order to achieve the desired result, the controlled chassis works in real time, automatically adjusting the shock absorbers. Less than six milliseconds elapse between measurement and force adjustment. The connection of the spring struts to the body now consists of significantly harder bearings to further improve steering precision and thus overall handling — the bearings are 130 percent (2.3 times) stiffer at the front and 77 percent (1.7 times) stiffer at the rear.

As a result, the Chiron Pur Sport runs with extreme precision. ''The driver knows in advance exactly where the Chiron Pur Sport is going, so only minimum steering movement is required. This precision and predictability make driving easier, significantly increasing driving pleasure,'' explains Jachin Schwalbe. Due to the new, softer tyres for increased road grip at the limit of driving dynamics, the negative camber and the significantly higher downforce, the Bugatti engineers decided to limit the top speed to 350 km/h. ''In return, the Chiron Pur Sport offers exceptional road grip over the entire speed range,'' says Jachin Schwalbe. Of course, this extremely sporty handling has to function on all roads and offer passengers sufficient comfort — whether on the Nordschleife or in city traffic. More than 50,000 test kilometres are required for chassis fine-tuning alone: the Chiron has now completed well over a million test kilometres in total. ''The combination of a firmer chassis, shorter gear ratio, more downforce and the new ESC-Sport+ driving mode is addictive. The Chiron Pur Sport selects the right gear in every situation, no matter how dynamic. It feels like it's glued to the road. Then you've got this tremendous acceleration. The car exceeds the expectations of even the most experienced drivers,'' explains Jachin Schwalbe.

15 PER CENT SHORTER GEAR RATIO

The seven-speed dual-clutch transmission has undergone a radical transformation: the Bugatti engineers shortened each gear and modified many components. All in all the gears have been shortened by 15 per cent. The Chiron Pur Sport accelerates from 0 to 100 in 2.3 seconds instead

of 2.4 seconds; and from 0 to 200 in 5.9 instead of 6.1 seconds. Moreover, it accelerates in sixth gear from 60 to 120 km/h in 4.4 seconds instead of 7.4. The vehicle's top speed is now electronically regulated at 350 km/h, with a maximum shift speed of 6,900 rpm. In order to align the shift points with the new gear ratios and altered shift speed, the shift strategy was subjected to extensive revision. Upshift and downshift control is perfectly adapted in all gears according to engine speed and load points. ''We spent one and half years developing the control system so as to ensure that every shift really does fit exactly in all driving conditions. First in simulation, then on the test stand and finally on test and circuit tracks as well as on country roads and motorways,'' says Carl Heilenkötter, transmission development engineer at Bugatti. ''Now everything is perfect!'' Every driver will immediately feel that the engine revs up faster, the gears are closer together and the gearbox shifts more quickly. One particular challenge according to Heilenkötter is to reach maximum shift speed just before the rev limiter intervenes so as to get as much power as possible from the engine to the road, especially in the event of slip and in all temperatures. Drivers who wish to shift gear themselves will use the easy to grab extended shift paddles behind the steering wheel.

HIGH-REVVING W16 ENGINE

To ensure the engine and gearbox harmonize perfectly with the modified ratios in all engine speed ranges, Bugatti has also refined the W16 engine with its 1,500 PS and 1,600 newton metres of torque. The 8.0-litre power unit now reaches its rated output between 6,700 and 6,900 rpm — in other words, it revs 200 rpm higher than the engine in the Chiron. The maximum engine speed is now 7,000 rpm. ''This nominal output plateau with the extended rev range allows longer availability of maximum power, enhancing the sense of emotion and sportiness. The driver immediately feels the engine speed dynamics with the higher tractive force,'' says Michael Gericke, engine developer at Bugatti. The gears are changed at an even faster rate. This is why the four turbochargers have to be accelerated all the time: here the engineers also had to retune the wastegate valves for boost pressure control. The W16 engine has been assigned new values for each of the seven gears. As a result, the Chiron Pur Sport accelerates in sixth gear from 60 to 120 km/h almost three seconds faster than the Chiron — which is already very fast. All in all, elasticity is 40 per cent higher than in the Chiron.

TYRES WITH EXTREMELY HIGH GRIP

Running through a number of test loops, the engineers at Bugatti and Michelin eventually found the perfect rubber compound for the best possible grip. The entirely newly developed Bugatti-exclusive Michelin Sport Cup 2 R tyres in size 285/30 R20 at the front and 355/25 R21 at the rear ensure exceptional grip even on tight corners taken at high speed. With a newly developed tyre structure and a softer rubber compound optimized for the chassis, this combination offers ten per cent more lateral acceleration, thereby further increasing the cornering speed and overall performance of the hyper sports car.

NEW AERO RIMS FOR INCREASED DOWNFORCE

For the Pur Sport, Bugatti has created a magnesium rim with optional Aero blades which is about four kilograms lighter. Arranged in a ring shape, the blades ensure optimum air extraction at the wheel arches while at the same time improving aerodynamics. When the vehicle is in motion,

the rings fitted to the rim help to suck the air through the wheel, which leads to an increase in downforce. A special cover on the five wheel bolts minimizes adverse air turbulence and visually finishes the wheel appearance. The total weight saving of 16 kilograms results in a reduction in the weight and lower unsprung masses. ''This increases traction because the wheel can be kept on the ground more effectively. Every driver will feel a sense of lightness in corners,'' explains Jachin Schwalbe. The vehicle weight is reduced by about 50 kilograms in total.

At the rear, a larger and longer diffuser and a fixed rear wing measuring 1.90 metres in width produce more downforce on the rear axle. This is perfectly balanced over the entire speed range by a large front splitter, wider front air intakes, wheel arch ventilation with optimized air outlets and a reduced standing height. All in all, this contributes to increased agility. At the same time, omission of the hydraulic component of the otherwise automatically extending spoiler reduces the weight by more than ten kilograms.

NEW ESC-SPORT+

In addition to the driving modes EB, Autobahn and Handling, the new ESC-Sport+ drive program provides significantly increased driving pleasure in Handling mode. When the ESC button is activated, ESC intervenes much later and allows more slip, thereby enabling controlled drifts and a greater drift angle. Bugatti drivers are able to control the Chiron Pur Sport very spectacularly using the throttle. It's a huge amount of fun,'' explains Christian Willmann, engineer responsible for driving dynamics slip control systems and all-wheel drive at Bugatti. ''It's a challenging task to control such a powerful engine with 1,600 newton metres of torque in such a way that it always provides sufficient traction in all weather conditions. In the Chiron Pur Sport, thanks to reduced traction control, we can now give the driver greater freedom on dry circuits,'' explains Christian Willmann. The great art is to control the engine torque so that the car accelerates noticeably without feeling constricted. ''The Chiron Pur Sport is not just sporty and safe on race tracks but on public roads in day-to-day driving, too,'' says Christian Willmann. A hyper sports car consistently calibrated for agility and performance.

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[2] Chiron: WLTP fuel consumption, l/100 km: low phase 44.6 / medium phase 24.8 / high phase 21.3 / extra high phase 21.6 / combined 25.2; CO2 emissions combined, g/km: 572; efficiency class: G

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